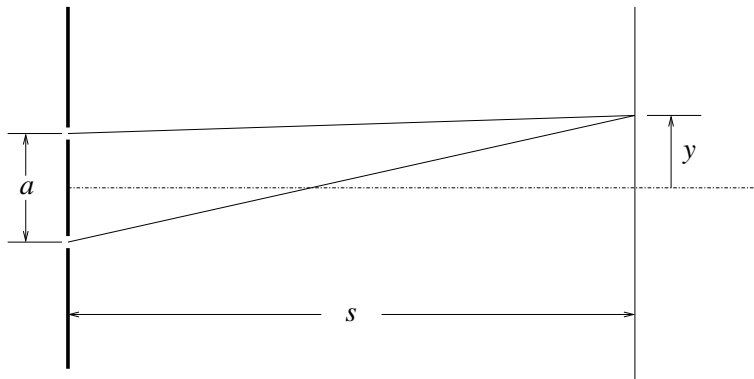


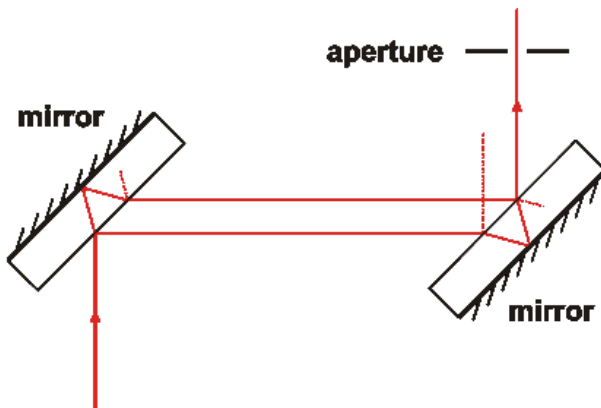
Physics 422 - Spring 2014 - Assignment #7, Due April 25th

1. Consider a double slit experiment in which two slits, separated by a distance a are located a distance s from a screen by a light source that has a wavelength λ but which has a relatively short coherence length of 3λ . That is, $\vec{E}(x) = \vec{E}(x+m\lambda)$ when $m < 3$, but $\vec{E}(x)$ is uncorrelated with $E(x+m\lambda)$ otherwise. Calculate the intensity of the light on the screen as a function of y .



2. A thin film coats the surface of a circular glass substrate to a nominal thickness of $1.8\mu m$. When illuminated by white light and viewed at normal incidence, the reflected light appears orange ($\lambda \sim 600\text{ nm}$) at the center but changes to green ($\lambda \sim 500\text{ nm}$) at the edge. If the glass has an index of refraction of 1.5 and the film has an index of refraction of 1.7, what is the variation in the thickness of the film?
3. (*Hecht 9.13*) Plane waves of monochromatic light impinge at an angle θ_i on a screen containing two narrow slits separated by a distance a . Derive an equation for the angle measured from the central axis which locates the m^{th} maximum.

4. (Hecht 9.38) A Jamin Interferometer is illustrated below.



(a) If the mirrors are made of glass with $n = 1.5$ and each have a thickness of 10 mm, what is the spacing between the horizontal paths of light?

(b) Two identical cells, 5 cm long, containing a certain liquid are placed in the path of each beam. If the temperature of one of the cells is changed and 50 interference fringes of green light ($\lambda = 500$ nm) are observed to shift, how much did the index of refraction change due to the change in temperature?

5. (Hecht 9.40) Given that the mirrors of a Fabry-Perot Interferometer have an amplitude reflection coefficient of $r = 0.8944$, find

- (a) the coefficient of finesse,
- (b) the half-width,
- (c) the the finesse, and,
- (d) the *contrast factor* defined by

$$C = \frac{(I_t/I_i)_{\max}}{(I_t/I_i)_{\min}}$$